REMARKS

No amendments to the claims are presented with this response. The pending claims are Claims 30-49.

35 USC 103(a): Claims 30 and 41

The examiner rejected Claims 30 and 41 as being unpatentable under 35 USC 103(a) over Henely (US 6,169,770) in view of Yu et al (US 2004/0136478) and Kriedte et al (US 2004/0100939).

In making the rejection the examiner stated that the method of Henely comprises (in part)

> passing the stream of received data through a preamble detector arranged to detect preamble symbols (preamble detector circuit 60 analyses the signal at input 64 to determine if a preamble has been detected, column 5, lines 22 – 25), when a pilot symbol is detected passing the stream of received data to a receiving apparatus without first passing the received data through the preamble detector (if preamble detection circuit 60 detects the preamble, preamble detector circuit 60 provides a control signal at output 84 to signal path switch circuit 70 and connects receive input 74 to path output 26 in response to receive the control signal from output 84, column 5, lines 27 – 32, by passing the received signal from 74 to path output 26, the preamble detection circuit 60 is being bypassed).

The Applicant submits that Henely does not disclose a system as alleged by the examiner. As described in Henely, signal path switch 70 receives as inputs (among others) a signal 84 from preamble detection circuit 60 as well as signal 74 from the output of high level mtl (minimum trigger level) processing circuit 40. Both signals 84 and 74 are continuously provided to signal switch path 70. The signal from the preamble detection circuit 60 is never provided to the baseband processing circuit 20. Instead the output from the preamble detection circuit is used to provide a control signal for the signal path switch 70 to pass signal 74 to the baseband processing circuit 20. Input 63 to preamble detection circuit 60 is shown as a solid line with no switching mechanism disclosed for bypassing the preamble detection circuit.

To show obviousness a prior art reference must be considered in its entirety, i.e., as a whole, including portions that would teach away from the claimed invention. *W.L Gore &*

Associates, Inc. v. Garlock, Inc., 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert denied*, 469 U.S. 851 (1984). Henely relates to a collision detection system in aircraft. Henely aims to provide a system where higher priority anti-collision messages (squitter messages from closer aircraft) are received even when the receiver is already processing another message. There is no disclosure in Henely that the preamble detection circuit 60 is removed from the receiver chain. In fact Henely teaches that the preamble detection circuit 60 remains part of the receiver chain even during reception of a signal through low level processing circuit 50 to signal path switch 70. Henely states the following at column 5, line 63, to column 6, line 2.

> Circuit 70 preempts a signal received at input 78 with a signal received at input 74 in response to the control signal at output 84, even though an end-of-message signal at output 90 has not yet been received from circuit 20. In this way, the squitter messages from a closer aircraft are received on a priority basis or pre-empt over squitter messages received from a distant aircraft.

That function could not be realized if the output from preamble detection circuit 60 is bypassed once a signal is received.

For all of the foregoing reasons, Henely does not disclose that the preamble detection circuit is bypassed, contrary to the examiner's assertion.

Interpretation of claim 30

The examiner also appears to have misread Claim 30. Applicant's Claim 30 states that the received data is passed through an adaptive filter to reduce interference from any narrowband interferer and then a correlator to detect pilot symbols. Once a pilot symbol is detected the received data is passed to the receiving apparatus without passing through the adaptive filter. Henely nowhere suggests the use of any filters to filter out interference or removing any interference reducing filter from the receiver chain. As Henely is silent on reducing any interference, Henely cannot suggest removing any interference reducing filter.

Combination of Kriedte and Henely

The Supreme Court noted in *KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385, 1396 (U.S. 2007) that the analysis supporting a rejection under 35 U.S.C. 103 should be made explicit. The Court quoted *In re Kahn, 441 F.3d 977, 988, 78 USPQ2d 1239, 1336,* (Fed. Cir. 2006) in which the court stated that "[R]ejections on obviousness cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness."

The examiner states that Kriedte (US 2004/0100939) discloses a preamble detection algorithm that is based on the correlation between the repeated symbols/codes constituting the preamble. The examiner goes on to state that it would have been obvious to combine this teaching of Kriedte in the method of Henely to simplify and reduce cost of the preamble detection process. The Applicant disagrees with those assertions.

Kriedte relates to an OFDM system. The preamble system described in Kriedte is designed to avoid inter-symbol interference (ISI) during channel impulse response recovery. Kriedte states at paragraph [0024], "In order to avoid ISI during channel impulse response (CIR) recovery, the cyclic shift should at least span the duration of the maximal-length CIR."

Henely is silent about the type of modulation used. Further Henely does not suggest that the preamble system in Henely is in any way inadequate. There is no suggestion in Henely that the preamble provided in Henely needs improvement. As Henely makes no mention of any problems with the preamble provided in Henely there is no motivation to replace this system with any other system.

Finally, it is far from clear that the system of Kriedte, which is designed for an OFDM system, could be used to improve the system of Henely or simplify or reduce the cost of the preamble detection process of Henely as suggested by the examiner. The Applicant submits that

the examiner has not provided anything more than a mere conclusory statement. The examiner has not provided a clear and rational technical explanation to support the conclusion of obviousness.

Combination of Henely, Kriedte and Yu

The examiner states that Yu (US 2004/0136478) discloses an equalizer to reduce interference before a pilot signal correlator. Yu employs a fast equalizer to "reduce the channel distortion" before a pilot signal correlator (see Yu at paragraph [0030]). The function of the equalizer described in Yu is the classical function, namely, to insert a pseudo-inverse to the multiplicative multipath channel, thereby "*reducing channel distortion*". (See, J. G. Proakis, *Digital Communications*, 2nd Edition, pp. 556 – 557, figures 6.4.2 and 6.4.3, New York, McGraw Hill, 1989.) The examiner has failed to show how and where Yu describes the removal of interference.

The examiner cites Kim (US 6,654,430) as an example of an equalizer used to remove narrowband interference. While the text relied on by the examiner ("... the equalizer ... removes interference noise such as intersymbol interference (ISI) and narrowband interference ...") mentions removal of narrowband interference, the Applicant submits that the examiner's interpretation of the reference is incorrect because elsewhere, Kim in Claim 1 describes the function of the apparatus to "... freeze the re-initialization state ... when HAM radio interference noise is detected in said signal from said equalizer." Clearly, the (narrowband) HAM radio interference cannot be detected at the output of the equalizer as described if the equalizer has removed the interference. The description of the equalizer function in Kim should properly be interpreted to mean that the equalizer removes intersymbol interference (ISI), which is an alternative description of the classical equalizer function of compensating for multipath channel dispersion.

Nonetheless, it is possible in principle to use an equalizer to reduce interference using mean square error linear feedback, refer to [See, e.g., Proakis at pp.561-576]. However, to achieve the purposes of the application, the requirements to use such an equalizer are circular and unsolvable. In order to remove narrowband interference so that pilot symbol detection and synchronization can be performed, the equalizer must estimate the narrowband interference. But, in order to estimate the narrowband interference, the equalizer must first detect and synchronize the pilot symbol. Thus, it is not possible to use an equalizer as described by Kim (or any other source) to remove narrowband interference to improve pilot symbol detection and synchronization. It is also noted that Kim does not mention removal of the equalizer when interference is detected.

To show obviousness a prior art reference must be considered as a whole including portions that would teach away from the claimed invention. It is clear that the equalizer in Yu is intended to remain in the receiver chain. For example paragraph [0030] of Yu states, in part, "The fast equalizer after the interpolator reduces the channel distortion to improve the pilot correlation and detection function and to help the final data detection in the final equalizer". Paragraph [0028] of Yu states, in part, "The fast timing equalizer is designed, in conjunction with the final equalizer, to minimize intersymbol interference (ISI) introduced by the transmitter and channel frequency characteristics". Those statements suggest that it is essential that the equalizer in Yu remains in the receiver chain. It would reduce the performance of Yu if the equalizer of Yu was used to reduce ISI when detecting the pilot symbol but was removed after the pilot symbol was detected. This would mean that detecting the remainder of the transmission involved detecting the transmission through ISI that was reduced only when the pilot symbol was detected. Clearly, such a system would reduce the performance of the receiver of Yu.

Because in Yu it is essential that the equalizer remains in place during all receiving stages, the Applicant submits that if Yu could somehow be combined with Henely, the resulting combination would provide a receiver where the equalizer was before the preamble detector and

remained in place at all times. Henely is silent on the feature of providing an equalizer before preamble detection and so cannot suggest that any such equalizer is removed from the receiver chain.

The Applicant further submits that the reasoning given by the examiner is technically incorrect because the equalizer described in Kim cannot possibly work to remove narrowband interference as stated. The examiner's reasoning is further incorrect because when the whole disclosure of Yu is considered, it is essential that the equalizer described in Yu must remain in the receiver chain to maintain the performance of Yu. Moreover, the reason given by the examiner for the combination of citations is that it would have been desirable to have an equalizer to reduce interference from any narrowband interferer because it will generate a clean signal and improve the integrity of the preamble detection process. That assertion does not support the examiner's conclusion that the equalizer should be bypassed once the preamble is detected. Given these reasons, there is no apparent support for the examiner's position that the documents show use of an equalizer to remove narrowband interference in a preamble and then bypass the equalizer once the preamble has been detected, as set forth in the Applicant's claim 30.

Additional considerations

The examiner states that it would have been obvious to one of ordinary skill in the art at the time of the invention to employ the teaching of Yu to place an equalizer before the preamble detection of the proposed combination of Henely and Kriedte to improve preamble detection and when the preamble is detected, bypass the preamble detector at the equalizer and passed the received signal to output 26 for further processing. The Applicant submits that it was the present application and an academic publication by the inventor, A. J. Coulson, "Narrowband interference in pilot symbol assisted OFDM systems", *IEEE Trans. Wireless Communications*, vol. 3 no. 6, pp.2277-2287, Nov. 2004, that first identified that narrowband interference has a severe impact on the performance of pilot symbol assisted receivers. That assertion regarding

the actual state of the art can be verified by reference to M. Marey, H. Steendam, "Analysis of the narrowband interference effect on OFDM timing synchronization", *IEEE Trans. Signal Processing*, vol. 55 no. 9, pp. 4555-4566, Sep. 2007, which states in the introduction that "... no previous research was done to investigate the effect of these (narrowband) signals on the performance of a (pilot symbol assisted) system". A copy of the Marey paper is attached for reference by the examiner. Because this effect had not been reported prior to publication of the Coulson article, it cannot be fairly said that the combination of steps set forth in claim 30 would have been obvious to one with ordinary skill in the art.

In summary, the Applicant submits that Applicant's claimed method as set forth in claim 30 is not obvious in view of Henely, Kriedte, Yu and Kim for at least the following reasons:

- None of the citations describes a system that initially passes a stream of received data through an adaptive filter to remove narrowband interference and when a pilot symbol is detected passes the stream of received data to the receiver apparatus without first passing the data through the adaptive filter.
- Henely does not provide a receiver where the preamble detection circuit is bypassed following preamble detection.
- Henely teaches away from bypassing the preamble detection circuit following preamble detection.
- It is not obvious to combine the preamble of Kriedte with the system of Henely to provide Henely with a repeated sequence for a preamble.
- Yu does not provide an equalizer to remove interference so it cannot be obvious to combine Yu with Henely or Kriedte to provide this feature as none of Henely, Kriedte or Yu to provide this feature.
- The equalizer of Kim cannot logically be used to remove narrowband interference because to do this the equalizer would have to first detect and synchronize the pilot symbol but the present application requires that narrowband interference is reduced before the pilot symbol is detected.

- Yu teaches away from removing an equalizer in the receiver chain.
- The Marey paper states that prior to the Coulson paper "... no previous research was done to investigate the effect of these (narrowband) signals on the performance of a (pilot symbol assisted) system".

For all of the foregoing reasons, the Applicant submits that claim 30 is allowable. Claim 41 is directed to an apparatus for carrying out the method set forth in claim 30. Therefore, claim 41 is allowable over the cited combination of references for at least the same reasons as claim 30.

35 USC 103(a): Claims 32 – 33 and 43 – 44

The examiner rejected claims 32 – 33 and 43 – 44 under 35 USC 103(a) as being unpatentable over Henely in view of Yu and Kriedte and further in view of Sugiyama (US 5,192,918). The Applicant respectfully traverses this rejection for the following reasons.

Claims 32 and 43

Claims 32 and 43 depend from claim 30 and 41 respectively, and introduce the feature that the adaptive filter uses a stream of received data delayed by a known length as a reference signal. The examiner states that such a feature would have been obvious in view of Sugiyama (figure 4 and column 4 lines 59 to 68) because the added feature reduces residual noise (column 2, line 32 – 33 of Sugiyama).

However, at column 2, lines 32 – 33 Sugiyama states that "Another shortcoming of the prior art is that, if signal s_k is present, the tap weights are updated with nonzero system output d_k, and a residual noise proportional to the stepsize is generated." That quote merely states that a signal on an adaptive filter introduces residual noise at the output. The quote does not state that using a reference signal as an input to the adaptive filter will overcome the problem of residual noise.

The Applicant submits that the examiner has not provided adequate reasons about why claims 32 and 43 are obvious because the reason given by the examiner does not logically produce the conclusion reached by the examiner. Therefore, the rejection is improper and should be withdrawn.

Claims 33 and 44

Claims 33 and 44 depend from claims 32 and 43, respectively, and introduce the feature that the delay length is longer than the length of the pilot symbol. The examiner states that although Sugiyama does not disclose that the delay length is longer than the length of the pilot symbol that it has been held that where the general condition of a claim is disclosed in the prior art, discovering the optimum or workable range involves only routine skill in the art.

In Sugiyama the adaptive filter, as shown in figure 4 and described, is used to produce a signal without a carrier signal and the carrier signal. The length of the delay in the reference signal described in Sugiyama is used to assist in the function of the adaptive filter to allow separation of the signal and the carrier signal.

In the Applicant's claimed method and apparatus as set forth in claims 33 and 44, respectively, the adaptive filter reduces noise from a narrowband interferer. Thus, the function of the adaptive filter of Sugiyama is completely different from the function of the adaptive filter in the Applicant's claimed method and apparatus. The Applicant submits that determining the length of the delay in the adaptive filter reference signal is not routine skill in the art because the uses of the two adaptive filters are significantly different. The different uses for the adaptive filter mean that the optimum delays in the reference signals are unrelated. Further, it is not obvious from Sugiyama that there should be a delay in a reference signal for an adaptive filter for reducing narrowband noise.

The Applicant submits that the examiner has not provided adequate reasons about why claims 33 and 44 are obvious. Therefore, the rejection is improper and should be withdrawn.

35 USC 103(a): Claims 31 and 42

The Examiner rejected claims 31 and 42 under 35 USC 103(a) as being unpatentable over Henely in view of Yu and Kriedte and further in view of Vandendorpe (US 6,400,781). The Applicant submits that these claims are allowable because they are dependent claims that depend from allowable base claims, claims 30 and 41, respectively. However, there are additional reasons why claims 31 and 42 are not obvious.

The examiner cites Vandendorpe as disclosing that narrowband distortions can be compensated by adapting the number of taps of the equalizer by enlarging the number of taps of the equalizer. However, Vandendorpe does not specify that the number of taps of the adaptive filter should be larger than the number of interferers to be cancelled as claimed in claims 31 and 42. The Applicant further notes that a relationship between the number of taps of the equalizer and the number of interferers to be cancelled cannot be inferred from Vandendorpe because Vandendorpe is silent on the possibility of such a relationship.

Further, to support the conclusion of obviousness under Section 103(a), the examiner asserts that it is desirable to have a number of taps in the adaptive filter greater than the maximum number of interferers to be cancelled because it can remove all the narrowband interference and improve signal integrity. However, the Applicant submits that the examiner has merely asserted that the feature of the applicant's claim is desirable and concluded that it must therefore be obvious. In other words, the examiner has not provided a proper analysis to support the rejection. A mere assertion by the examiner is not a sufficient basis for obviousness.

35 USC 103(a): Claims 34, 45 and 46

The Examiner rejected claims 34, 45, and 46 under 35 USC 103(a) as being unpatentable over Henely in view of Yu and Kriedte and further in view of Mellon (US 4,910,521). In making the rejection the examiner states that it would have been obvious to detect a peak in a sliding correlator and, when the peak is detected in the sliding correlator operating a pilot symbol detector to detect the pilot symbol because it would reduce the cost and increase the reliability. The examiner concluded that it would have been obvious to use the teaching of Mellon in the proposed combination of Henely, Yu and Kriedte to reduce cost and increase reliability.

None of Henely, Yu and Kriedte suggests that the step of detecting the pilot symbol is costly or unreliable. Henely and Kriedte describe different methods for detecting preambles and neither of those methods is described as costly or unreliable. It cannot be obvious to provide a solution where the art has not identified a problem with the known processes or systems.

The examiner's reason for combining Mellon with the other references is that adding the feature described in Mellon would reduce cost and increase reliability. The Applicant interprets the examiner's assertion to mean that the cost of the receiver would decrease and that the reliability of the receiver would increase. The examiner gives no measure of what cost would reduced (for example, price, component numbers, layout area etc). Further the examiner relies on a passage in Mellon that says that an object of Mellon is to "provide a receiver system which is reduced in cost and increased in terms of reliability" (See, Mellon at column 2, lines 1- 3). Neither the examiner nor Mellon provides any evidence that detecting a peak in a sliding correlator and when the peak is detected in the sliding correlator, operating a pilot symbol detector to detect the pilot symbol as described by Mellon would meet such an objective. Likewise, neither the examiner nor Mellon demonstrates that a pilot symbol detector as described by Mellon would meet that objective.

For all of the foregoing reasons, the Applicant submits that the examiner has failed to present a *prima facie* case of obviousness relative to claims 34, 45, and 46.

35 USC 103(a): Claims 35 and 47 to 49

The examiner rejected claims 35, 47- 49 under 35 USC 103(a) as being unpatentable over Henely, Yu, Kriedte, and Mellon and further in view of Nelson (US 5,355,126). In making the rejection, the examiner concluded that it would have been obvious to incorporate a pilot symbol timeout system as described in Nelson into the proposed combination of Henely, Yu, Kriedte, and Mellon.

To establish obviousness under Section 103(a), a prior art reference must be considered in its entirety because it is error to ignore portions that teach away from the claimed invention. In Henely it is critical that the preamble detector is always operating so that if any messages are received they can be prioritized. In the system of Henely the preamble detector provides a signal to the signal path switch circuit 70 when a preamble is detected. This system must always operate so that the anti-collision system of Henely operates correctly. It is therefore, not obvious to provide a timeout system in a receiver using the preamble detection of Henely as this contradicts the teaching of Henely.

With regard to the rejection as applied to claim 49, the examiner suggests that in the proposed combination of Henely, Yu and Mellon, replacing the preamble detector of Henely by the preamble detector of Mellon with the equalizer of Yu, when a preamble is detected by a preamble detector as disclosed in Henely, a signal is set to bypass the equalizer and the preamble detector. The examiner appears to be suggesting that replacing the preamble detector of Henely with that of Mellon and then detecting a preamble with the preamble detector of Henely. It is not obvious (nor possible) to replace one preamble detector with another and then receive a signal from the replaced preamble detector. For a start the preamble detector of Henely forms part of the examiner's combination of citations on which the base claim for claim 49 is rejected. Finally

as previously discussed, Henely does not describe bypassing the preamble detector once a preamble is detected. In fact Henely describes the opposite.

The Applicant submits that the examiner has not provided sufficient reasons why the combination of citations would render claims 48 and 49 obvious. Such an explanation is required by KSR.

For all of the foregoing reasons, the Applicant submits that the examiner has failed to present a *prima facie* case of obviousness relative to claims 35 and 47-49.

35 USC 103(a): Claims 37 and 38

The examiner rejected claims 37 and 38 under 35 USC 103(a) as being unpatentable over Henely in view of Yu et al., Kriedte et al., Nelson et al., and Mellon.

Claim 37

The Applicant submits that Henely does not disclose a system as alleged by the examiner. As described in Henely, signal path switch 70 receives as inputs (among others) a signal 84 from preamble detection circuit 60 as well as signal 74 from the output of high level mtl (minimum trigger level) processing circuit 40. Both signals 84 and 74 are continuously provided to signal switch path 70. The signal from the preamble detection circuit 60 is never provided to the baseband processing circuit 20. Instead the output from the preamble detection circuit is used to provide a control signal for the signal path switch 70 to pass signal 74 to the baseband processing circuit 20. Input 63 to preamble detection circuit 60 is shown as a solid line with no switching mechanism disclosed for bypassing the preamble detection circuit.

To show obviousness a prior art reference must be considered in its entirety, i.e., as a whole, including portions that would teach away from the claimed invention. *W.L Gore &*

Associates, Inc. v. Garlock, Inc., 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert denied*, 469 U.S. 851 (1984). Henely relates to a collision detection system in aircraft. Henely aims to provide a system where higher priority anti-collision messages (squitter messages from closer aircraft) are received even when the receiver is already processing another message. There is no disclosure in Henely that the preamble detection circuit 60 is removed from the receiver chain. In fact Henely teaches that the preamble detection circuit 60 remains part of the receiver chain even during reception of a signal through low level processing circuit 50 to signal path switch 70. Henely states the following at column 5, line 63, to column 6, line 2.

> Circuit 70 preempts a signal received at input 78 with a signal received at input 74 in response to the control signal at output 84, even though an end-of-message signal at output 90 has not yet been received from circuit 20. In this way, the squitter messages from a closer aircraft are received on a priority basis or pre-empt over squitter messages received from a distant aircraft.

That function could not be realized if the output from preamble detection circuit 60 is bypassed once a signal is received.

For all of the foregoing reasons Henely does not disclose that the preamble detection circuit is bypassed.

Interpretation of claim 37

The examiner also appears to have misread Claim 37. Applicant's Claim 37 states that the received data is passed through an adaptive filter to reduce interference from any narrowband interferer and then a correlator to detect pilot symbols. Once a pilot symbol is detected the received data is passed to the receiving apparatus without passing through the adaptive filter. Henely nowhere suggests the use of any filters to filter out interference or removing any interference reducing filter from the receiver chain. As Henely is silent on reducing any interference, Henely cannot suggest removing any interference reducing filter.

Combination of Kriedte and Henely

The Supreme Court noted in *KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385, 1396 (U.S. 2007) that the analysis supporting a rejection under 35 U.S.C. 103 should be made explicit. The Court quoted *In re Kahn, 441 F.3d 977, 988, 78 USPQ2d 1239, 1336,* (Fed. Cir. 2006) in which the court stated that "[R]ejections on obviousness cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness."

The examiner states that Kriedte (US 2004/0100939) discloses a preamble detection algorithm that is based on the correlation between the repeated symbols/codes constituting the preamble. The examiner goes on to state that it would have been obvious to combine this teaching of Kriedte in the method of Henely to simplify and reduce cost of the preamble detection process. The Applicant disagrees with those assertions.

Kriedte relates to an OFDM system. The preamble system described in Kriedte is designed to avoid inter-symbol interference (ISI) during channel impulse response recovery. Kriedte states at paragraph [0024], "In order to avoid ISI during channel impulse response (CIR) recovery, the cyclic shift should at least span the duration of the maximal-length CIR."

Henely is silent about the type of modulation used. Further Henely does not suggest that the preamble system in Henely is in any way inadequate. There is no suggestion in Henely that the preamble provided in Henely needs improvement. As Henely makes no mention of any problems with the preamble provided in Henely there is no motivation to replace this system with any other system.

Finally, it is far from clear that the system of Kriedte, which is designed for an OFDM system, could be used to improve the system of Henely or simplify or reduce the cost of the preamble detection process of Henely as suggested by the examiner. The Applicant submits that

the examiner has not provided anything more than a mere conclusory statement. The examiner has not provided a clear and rational technical explanation to support the conclusion of obviousness.

Combination of Henely, Kriedte and Yu

The examiner states that Yu discloses an equalizer to reduce interference before a pilot signal correlator. Yu employs a fast equalizer to "reduce the channel distortion" before a pilot signal correlator (see Yu at paragraph [0030]). The function of the equalizer described in Yu is the classical function, namely, to insert a pseudo-inverse to the multiplicative multipath channel, thereby "*reducing channel distortion*". (See, J. G. Proakis, *Digital Communications*, 2nd Edition, pp. 556 – 557, figures 6.4.2 and 6.4.3, New York, McGraw Hill, 1989.) The examiner has failed to show how and where Yu describes the removal of interference.

The examiner cites Kim (US 6,654,430) as an example of an equalizer used to remove narrowband interference. While the text relied on by the examiner ("... the equalizer ... removes interference noise such as intersymbol interference (ISI) and narrowband interference ...") mentions removal of narrowband interference, the Applicant submits that the examiner's interpretation of the reference is incorrect because elsewhere, Kim in Claim 1 describes the function of the apparatus to "... freeze the re-initialization state ... when HAM radio interference noise is detected in said signal from said equalizer." Clearly, the (narrowband) HAM radio interference cannot be detected at the output of the equalizer as described if the equalizer has removed the interference. The description of the equalizer function in Kim is properly interpreted to mean that the equalizer removes intersymbol interference (ISI), which is an alternative description of the classical equalizer function of compensating for multipath channel dispersion.

Nonetheless, it is possible in principle to use an equalizer to reduce interference using mean square error linear feedback, refer to [See, e.g., Proakis at pp.561-576]. However, to

achieve the purposes of the application, the requirements to use such an equalizer are circular and unsolvable. In order to remove narrowband interference so that pilot symbol detection and synchronization can be performed, the equalizer must estimate the narrowband interference. But, in order to estimate the narrowband interference, the equalizer must first detect and synchronize the pilot symbol. Thus, it is not possible to use an equalizer as described by Kim (or any other source) to remove narrowband interference to improve pilot symbol detection and synchronization. It is also noted that Kim does not mention removal of the equalizer when interference is detected.

To show obviousness a prior art reference must be considered as a whole including portions that would teach away from the claimed invention. It is clear that the equalizer in Yu is intended to remain in the receiver chain. For example paragraph [0030] of Yu states, in part, "The fast equalizer after the interpolator reduces the channel distortion to improve the pilot correlation and detection function and to help the final data detection in the final equalizer". Paragraph [0028] of Yu states, in part, "The fast timing equalizer is designed, in conjunction with the final equalizer, to minimize intersymbol interference (ISI) introduced by the transmitter and channel frequency characteristics". Those statement suggest that it is essential that the equalizer in Yu remains in the receiver chain. It would reduce the performance of Yu if the equalizer of Yu was used to reduce ISI when detecting the pilot symbol but was removed after the pilot symbol was detected. This would mean that detecting the remainder of the transmission involved detecting the transmission through ISI that was reduced only when the pilot symbol was detected. Clearly, such a system would reduce the performance of the receiver of Yu.

Because in Yu it is essential that the equalizer remains in place during all receiving stages, the Applicant submits that if Yu could somehow be combined with Henely the resulting combination would provide a receiver where the equalizer was before the preamble detector and remained in place at all times. Henely is silent on the feature of providing an equalizer before

preamble detection and so cannot suggest that any such equalizer is removed from the receiver chain.

The Applicant further submits that the reasoning given by the examiner is technically incorrect because the equalizer described in Kim cannot possibly work to remove narrowband interference as stated. The examiner's reasoning is further incorrect because when the whole disclosure of Yu is considered, it is essential that the equalizer described in Yu must remain in the receiver chain to maintain the performance of Yu. Moreover, the reason given by the examiner for the combination of citations is that it would have been desirable to have an equalizer to reduce interference from any narrowband interferer because it will generate a clean signal and improve the integrity of the preamble detection process. That assertion does not support the examiner's conclusion that the equalizer should be bypassed once the preamble is detected. Given these reasons, there is no apparent support for the examiner's position that the documents show use of an equalizer to remove narrowband interference in a preamble and then bypass the equalizer once the preamble has been detected, as set forth in claim 37.

Additional remarks

The examiner states that it would have been obvious to one of ordinary skill in the art at the time of the invention to employ the teaching of Yu to place an equalizer before the preamble detection of the proposed combination of Henely and Kriedte to improve preamble detection and when the preamble is detected, bypass the preamble detector at the equalizer and passed the received signal to output 26 for further processing. The Applicant submits that it was the present application and an academic publication by the inventor, A. J. Coulson, "Narrowband interference in pilot symbol assisted OFDM systems", *IEEE Trans. Wireless Communications*, vol. 3 no. 6, pp.2277-2287, Nov. 2004, that first identified that narrowband interference has a severe impact on the performance of pilot symbol assisted receivers. That assertion regarding the actual state of the art can be verified by reference to M. Marey, H. Steendam, "Analysis of the narrowband interference effect on OFDM timing synchronization", *IEEE Trans. Signal*

Processing, vol. 55 no. 9, pp. 4555-4566, Sep. 2007, which states in the introduction that "... no previous research was done to investigate the effect of these (narrowband) signals on the performance of a (pilot symbol assisted) system". A copy of the Marey paper is attached for reference by the examiner. Because this effect had not been reported prior to publication of the Coulson article, it cannot be fairly said that the combination of steps set forth in claim 37 would have been obvious to one with ordinary skill in the art.

In summary, the Applicant submits that Applicant's claimed method as set forth in claim 37 is not obvious in view of Henely, Kriedte, Yu and Kim for at least the following reasons:

- None of the citations describes a system that initially passes a stream of received data through an adaptive filter to remove narrowband interference and when a pilot symbol is detected passes the stream of received data to the receiver apparatus without first passing the data through the adaptive filter.
- Henely does not provide a receiver where the preamble detection circuit is bypassed following preamble detection.
- Henely teaches away from bypassing the preamble detection circuit following preamble detection.
- It is not obvious to combine the preamble of Kriedte with the system of Henely to provide Henely with a repeated sequence for a preamble.
- Yu does not provide an equalizer to remove interference so it cannot be obvious to combine Yu with Henely or Kriedte to provide this feature as none of Henely, Kriedte, or Yu to provide this feature.
- The equalizer of Kim cannot logically be used to remove narrowband interference because to do this the equalizer would have to first detect and synchronize the pilot symbol but the present application requires that narrowband interference is reduced before the pilot symbol is detected.
- Yu teaches away from removing an equalizer in the receiver chain.

- The Marey paper states that prior to the Coulson paper "... no previous research was done to investigate the effect of these (narrowband) signals on the performance of a (pilot symbol assisted) system".

For all of the foregoing reasons, the Applicant submits that claim 37 is allowable.

Claim 38

The Applicant submits that claim 38 is allowable because it depends on an allowable base claim. Further the examiner provides no reasons why the combination of Mellon with the other citations would be obvious.

35 USC 103(a): Claim 39

The examiner rejected claim 39 under 35 USC 103(a) as being unpatentable over Henely, Yu, Kriedte, Nelson, Mellon, and further in view of Vandendorpe. In making the rejection, the examiner asserted that Vandendorpe discloses that narrowband distortions can be compensated by adapting the number of taps of the equalizer by enlarging the number of taps of the equalizer. However, Vandendorpe does not specify that the number of taps of the adaptive filter should be larger than the number of interferers to be cancelled as set forth in claim 39. The Applicant further submits that a relationship between the number of taps of the equalizer and the number of interferers to be cancelled cannot be inferred from Vandendorpe as Vandendorpe is silent on the possibility of such a relationship.

Further the examiner asserts that it is desirable to have a number of taps in the adaptive filter greater than the maximum number of interferers to be cancelled because it can remove all the narrowband interference and improve signal integrity and he then concludes that the proposed combination would have been obvious. The Applicant submits that the examiner has merely asserted that a feature of the Applicant's claimed method as set forth in claim 39 is desirable and then concluded that it must therefore be obvious to add such a feature to the

proposed combination. The Applicant further submits that the examiner has not provided a proper analysis to support the rejection as required by KSR. A mere assertion by the examiner is not a sufficient basis for obviousness.

For all of the foregoing reasons, the examiner has failed to present a *prima facie* case of unpatentability relative to claim 39. Therefore, the rejection is improper and should be withdrawn.

35 USC 103(a): Claim 40

The examiner rejected claim 40 under 35 USC 103(a) as being unpatentable over Henely in combination with Yu, Kriedte, Nelson, Mellon, and Sugiyama. The applicant's claimed method as set forth in Claim 40 includes the feature that the adaptive filter uses a stream of received data delayed by a known length as a reference signal. The examiner states that such a feature would have been obvious in view of the disclosure of Sugiyama (figure 4 and column 4 lines 59 to 68). The examiner concluded that such combination would have been suggested because the feature from Sugiyame reduces residual noise (column 2, line 32 – 33 of Sugiyama).

Column 2, lines 32 – 33 of Sugiyama reads as follows: "Another shortcoming of the prior art is that, if signal s_k is present, the tap weights are updated with nonzero system output d_k, and a residual noise proportional to the stepsize is generated." That quote merely states that a signal on an adaptive filter introduces residual noise at the output. The text does not state or imply that using a reference signal as an input to the adaptive filter will overcome the problem of residual noise.

In addition to the arguments provided above regarding the proposed combination of Henely, Kriedte, Yu, Nelson, and Mellon, the Applicant submits that the examiner has not provided adequate reasons as to why the Applicant's claimed method as set forth in claim 40 is obvious. The reasons given by the examiner do not necessarily produce the conclusion reached

by the examiner. Accordingly, the examiner has failed to present a *prima facie* case of unpatentability relative to claim 40. Therefore, the rejection is improper and should be withdrawn.

In any event, claim 40 depends from claim 37 and thus, includes all of the features of claim 37. Therefore, claim 40 is allowable for at least the same reasons as claim 37.

Further Remarks

In rejecting the claims the examiner relies on a minimum of three documents and as many as six documents to form the basis of each rejection. The Applicant submits that the examiner has not shown that when the documents are combined the applicant's invention is the obvious result of the combination. Instead the examiner appears to have searched for documents that describe one or more particular features of the Applicant's method and apparatus and picked only those features for the combination. This has led to combinations that disagree with the teaching of the individual disclosures.

The Applicant is the first to investigate the effect of narrowband signals on the performance of a multicarrier system and to provide a receiver designed to combat this problem. As evidence of this the Applicant is submitting herewith a copy of the paper by Marey and Steendam which states in the introduction that "... *no previous research was done to investigate the effect of these (narrowband) signals on the performance of a (pilot symbol assisted) system*". As this effect had not been reported prior to publication of the Applicant's paper or the filing of the present application (A. J. Coulson, "Narrowband interference in pilot symbol assisted OFDM systems", *IEEE Trans. Wireless Communications*, vol. 3 no. 6, pp.2277-2287, Nov. 2004), it cannot be said that the combination presented in the application "would have been obvious to one with ordinary skill in the art". The Coulson paper, by the inventor, appeared contemporaneously with the patent application.

To reach a proper determination under 35 U.S.C. 103 the examiner must put aside knowledge of the Applicant's disclosure when stepping backwards in time to determine whether the claimed invention was obvious at the time it was made. The Applicant submits that the examiner has engaged in impermissible hindsight to arrive at his/her conclusions. In providing reasons why it is obvious to combine the documents cited by the examiner and to reach the conclusions reached by the examiner the examiner does no more than assert that the feature found in the last citation would be desirable and therefore obvious to combine with the other steps or features as the case may be. In some of the examiner's rejections the examiner has not even done that.

Many of the examiner's reasons with regard to the citation of Mellon say that adding the feature provided by Mellon would be obvious because it would reduce in cost and increase in terms of reliability. The Applicant can only assume the examiner means that the cost of the receiver would decrease and the reliability of the receiver would increase. The examiner gives no measure of what cost would reduce (for example, price, component numbers, layout area etc). Further the examiner relies on a passage in Mellon that says that an object of Mellon is to "provide a receiver system which is reduced in cost and increased in terms of reliability" (Mellon, column 2, lines 1- 3). Neither the examiner nor Mellon demonstrates that substitution of the features of Mellon chosen by the examiner would meet this object.

Given the breadth of the prior art that the examiner has drawn upon and discarded the Applicant submits that more detailed reasoning is required to show why the combination is obvious. Otherwise, the examiner appears to be using hindsight and picking features from patents to combine into a receiver while ignoring a plethora of other options to arrive at his/her conclusions. Such hindsight analysis is impermissible to support a conclusion of obviousness under Section 103(a). If the examiner were not aware of the Applicant's claimed method and apparatus and was given Henely, Yu and Kriedte the Applicant believes that the examiner could

not have arrived at the applicant's claimed method and apparatus as claimed in claim 30 and claim 41, respectively.

CONCLUSION

In view of the foregoing remarks, it is believed that all of the pending claims are in condition for allowance. The Applicant respectfully requests that the Examiner reconsider the rejections of the claims in the light of the foregoing remarks.

Respectfully submitted,

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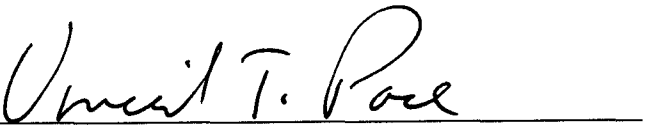
By 
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